Division of Roles between Compulsory and Voluntary Insurance: The Case of Japanese Automobile Liability Insurance Scheme

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ABSTRACT

This study attempts to provide a theoretical framework for the division of roles between compulsory and voluntary automobile insurance by analyzing the effects of the Japanese double-layered scheme on insurance availability and adverse selection. Japanese automobile insurance is unique as it consists of two different components: compulsory automobile liability insurance, operated under tariff rates, and voluntary automobile insurance, under which certain types of risk classifications are allowed. The Japanese scheme is doubtlessly viable since it has successfully contributed to the availability of insurance coverage and avoided an increase in uninsured motorists. It is, however, still controversial because the double-layered mechanism can increase the transaction costs borne by the concerned parties including insurers, policyholders, and regulators. Nevertheless, there are not many existing studies specific to automobile insurance that analyze the optimal domain of compulsory and voluntary insurance, which will efficiently ensure insurance availability and avoid adverse selection. Our investigation emulates the approach of Zweifel (2000), which provides implications on social and private insurance in the life and health insurance sector from the aspect of market equilibrium. However, we substantially expand his analytical model to compulsory and voluntary automobile insurance to better reflect the actual practices in the Japanese market. Our analysis shows that the double-layered automobile insurance system is cost-effective in minimizing adverse selection and preserving insurance availability only when compulsory insurance is provided at the contact point between the fair-price line of the pooled premium and the indifference curve of low-risk drivers, and simultaneously, voluntary insurance is offered in the surplus area of compulsory insurance on a risk-differentiated basis.

Key words: compulsory automobile liability insurance, voluntary automobile insurance, market equilibrium, insurance availability, adverse selection

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1. Purpose

This study aims to construct a theoretical framework for the division of roles between compulsory and voluntary automobile insurance by observing the unique Japanese automobile insurance system. The Japanese system consists of two different components: compulsory automobile liability insurance (CALI) and voluntary automobile insurance. CALI covers losses for bodily injury liability up to certain limitations, while voluntary insurance covers the excess losses over the CALI coverage. The premium rate structure is totally different between these two types of insurance. Premium rates for CALI are virtually uniform throughout the market and competition is eliminated in order to preserve availability and affordability of insurance coverage for bodily injury liability risks. Meanwhile, for voluntary automobile insurance, insurers are allowed to assess various risk factors including drivers' age, gender, driving records, and region. Such a double-layered scheme is often employed in the health insurance sector in many countries, but is uniquely observed in the automobile insurance market in Japan.[1)] Most developed countries mandate automobile users to maintain liability insurance in connection with their ownership and use of their automobile.[2)] In those countries, automobile owners are required to purchase liability coverage with a designated minimum amount, and can voluntarily purchase additional coverage. Insurers generally use a single rating plan applicable to both types of insurance and issue a single policy to a policyholder.

The Japanese automobile insurance system has successfully contributed to the preservation of availability and affordability of insurance coverage for automobile liability risks, avoided an increase in uninsured motorists, and at the same time, promoted the efficiency of insurers' operations through a moderate level of competition. It is, however, still controversial because it can increase the transaction costs borne by the concerned parties including insurers, policyholders, and regulators. CALI provides each policyholder with standardized coverage at a pooled price regardless of the risk characteristics of each driver. As a result, low-risk drivers may have an incentive to withdraw from the compulsory insurance system. Therefore, CALI may need to charge higher premiums to avoid adverse selection and force all drivers to participate in the system.

Recognizing the possible advantages and disadvantages discussed above, we attempt to construct a framework for the double-layered automobile insurance system that would contribute to market efficiency by preserving availability and affordability of insurance coverage, and simultaneously,

1) Korea used to have a similar system for its automobile insurance consisting both CALI and voluntary insurance, but the insurance coverage of two lines of insurance were integrated into a single policy in 1994, followed by the unification of the rating structure in 1997, according to Lee (2009), p.9.

2) Skipper and Kwon (2007), p.247.

minimize the transaction costs imposed on the parties concerned.

2. Description of the Automobile Insurance System in Japan

CALI. CALI operates under the Automobile Liability Security Law of 1955 in accordance with the social purpose of this insurance law, that is, to provide relief to victims of automobile accidents and ensure the sound development of automobile transportation.[3] CALI covers losses attributable to bodily injury liability only up to the limits specified for death, permanent disability, and injury by the law.[4] All automobile users are required to be insured by CALI and all licensed non-life insurers are obliged to provide this insurance coverage to all applicants. In order to ensure the compulsion of insurance, CALI is tightly linked to the vehicle inspection system; no vehicle without effective CALI coverage can be passed through the inspection.

Tariff rates, called Standard Full Rates, are calculated for CALI in accordance with the No-loss No-profit Rule by the Non-life Insurance Rating Organization of Japan.[5] The rates are set at a level that allows all insurers to soundly underwrite CALI policies, but does not allow them to earn any profit. The rates include not only pure premium rates but also expense loadings. The risk classification is limited and uniform among insurers.[6] Insurers can directly use the Standard Full Rates without obtaining individual approvals from the regulatory authority. Insurers can simply use the Standard Full Rates as their own rates after the commissioner of the Financial Service Agency approves the rates filed by the rating organization.[7] Therefore, the premium rates of CALI are virtually uniform throughout the market.

Voluntary Automobile Insurance. Voluntary automobile insurance provides a wider range of coverage, including third party liability coverage—which insures against not only bodily injury but also property damage, as well as self-incurred personal accidents, the insured's injuries, and damage to the insured's vehicle.[8] With respect to liability risk for bodily injury, voluntary insurance functions as excess

3) Non-life Insurance Rating Organization of Japan (2010), pp. 3-4.

4) Limitations of coverage currently in force are \30 million for death, \1.2 million for injury, and \0.75 to \40 million for permanent disability according to the grade of disability.

5) The Anti-Monopoly Law does not apply to certain activities of the rating organization, including calculation of Standard Full Rates and the use of the rates by its member insurers.

6) Non-Life Insurance Rating Organization of Japan (2010), p.11. Premium rates for CALI are classified only according to the size and use of vehicle. Regional rates are exceptionally applied to Okinawa Prefecture and isolated islands.

7) Non-Life Insurance Rating Organization of Japan (2010), p.10.

8) Skipper and Kwon (2007), pp. 587-588.

coverage to CALI. Since the deregulation in the Japanese non-life insurance sector in 1998, insurers have been allowed to set their own policy conditions and have started developing their own insurance products, which offer a variety of coverage in the voluntary automobile insurance market.

Insurers are also allowed to set their own premium rates for voluntary automobile insurance by obtaining prior approval from the regulatory body. The Non-life Insurance Rating Organization of Japan calculates only advisory pure premium rates, called Reference Loss Cost Rates, and member insurers can use the advisory rates for the pure premium component of their own rates but are not mandated to use them. The risk factors permitted under the Enforcement Regulations of the Insurance Business Law include driver's age, gender, driving experience, purpose of automobile usage, millage, region, vehicle type, vehicle safety device, and multicar ownership. In addition, the bonus-malus system, a form of experience ratings, applies to voluntary insurance. After the deregulation, insurers started introducing their own rating plans, which currently vary among insurers and their insurance products.

3. Literature Motivating the Study

Theoretical Literature on Compulsory Insurance. Many theoretical studies have discussed the economic rationale of compulsory insurance. Harrington and Niehaus (2003) focused on the incentive of drivers and discussed the possibility that compulsory automobile insurance can reduce the cost of risk by getting people to consider more of the costs of their actions when deciding on factors such as whether to drive, what type of vehicle to purchase, and how safely to drive.[9] For instance, if automobile insurance is not mandatory, some people will drive even though the full costs that arise when they drive exceed the benefits, and thus, compulsory insurance will make some of these people give up driving (i.e., it reduces the cost of risk). They also stated that compulsory insurance may encourage people to drive more safely, provided that the premiums are based on the driving record. Such safety effects, however, cannot be expected under Japanese CALI since its premiums are set only on the basis of the type of vehicle, as described above.

Harrington and Niehaus (2003) pointed out further limitations of compulsory automobile insurance:[10] compulsory insurance coverage tends to shift income from lower-income people with few assets to higher-income people with more assets and produces a regressive impact on the distribution of income. This regressive subsidy may be improved by limiting the compulsory part of the insurance coverage and minimizing the premiums paid by policyholders. Japanese CALI, which only provides bodily

9) Harrington and Niehaus (2003), pp.261-262.

10) Harrington and Niehaus (2003), pp.262-265.

injury liability coverage for a limited amount at relatively lower premiums, may have resolved, at least partly, this problem. This can be assumed from the fact that the percentage of uninsured motorists has reached close to zero and no assigned risk plans are necessary in the Japanese automobile insurance market. Significantly, Japanese CALI, by providing uniformed coverage at a uniformed price, mitigates the problem of adverse selection, as discussed earlier. However, the strong enforcement of insurance to minimize this problem may increase the costs of screening uninsured motorists and impose penalties on them. Santerre and Neun (2007) focused on public health insurance as part of the social security system and analyzed the economic rationale of making this insurance compulsory.[11] They contended that the government would produce insurance coverage only to the extent that consumers cannot resolve the information problem efficiently, but also emphasized that, when the costs to operate public insurance are too high, an alternative scheme including for-profit private insurance may be a substitute.

As one of the important studies that attempted to theoretically analyze the double-layered structure of insurance, Zweifel (2000) reviewed the reasons for the existence and growth of social insurance and discussed efficiency reasons for a division of labor between private and social insurance.[12] He extended the Separating Nash Equilibrium Model of Rothschild and Stiglitz (1976)[13] and demonstrated that partial mandatory insurance can alleviate adverse selection problems and enhance a Pareto improvement for both good- and bad-risk individuals. In addition, he illustrated that private insurers' inability to precisely estimate the probability of loss of individual exposure may constitute an efficiency reason for mandatory insurance with partial coverage.

Discussion on Risk Classification. Numerous previous studies have analyzed the risk classification of insurance from various dimensions. Crocker and Snow (1986) considered the efficiency effects of risk classification, also based on the Separating Nash Equilibrium model of Rothschild and Stiglitz (1976),[17] and established that, even though the risk evaluation is imperfect, costless classification always enhances efficiency.[14] They pointed out, however, that excessive costs for risk classification may impair market efficiency. Hoy (1982) analyzed the welfare implications of risk classification in the insurance market under conditions of asymmetric information by comparing various Wilson-type equilibria and demonstrated the possibility that excessive risk classification regardless of cost may not only deteriorate market efficiency but also cause cream skimming, resulting in an increase in the

11） Santerre and Neun (2007), pp.229-292.
12） Zweifel (2000), pp.933-966.
13） Rothschild and Stiglitz (1976), pp.629-649.
14） Crocker and Snow (1986), pp.335-338.

number of uninsured individuals.[15] Doherty (2000) analyzed risk classification in relation to multiperiod contracts and adverse selection by extending the contributions of preceding studies, and illustrated an appropriate risk classification that attracts high- and low-risk individuals separately through the self-selection process.[16]

With regard to the automobile insurance market, Harrington and Doepinghaus (1993) examined the efficiency consequences of government-imposed restrictions on risk classification in the automobile insurance market on the basis of a hypothetical compensation test.[17] They demonstrated that risk-classified premium rates can be more efficient than pooled, cross-subsidized rates only when the cost for insurers is low enough to compensate for the utility loss of high-risk policyholders. Suzawa (2008) tested the efficiency of Pay-As-You-Drive automobile insurance by utilizing the satellite communications technology, which is the most advanced risk-differentiated insurance product, by extending the analytical model of Harrington and Doepinghaus (1993), and illustrated that there is a tradeoff problem between the accuracy of risk evaluation and the cost of risk classification.[18] These previous studies of risk classification, combined with those of compulsory insurance referred to earlier, provide implications from various dimensions for the effectiveness of the Japanese automobile insurance scheme, consisting of CALI under the tariff rate system and voluntary insurance on a risk-differentiated basis.

Empirical and Simulation Analyses of Rate Regulation. Numerous empirical studies have analyzed risk classification and the impact of insurance rate regulation. Doepinghaus and Moor (1994) focused on the bonus-malus system of automobile insurance and investigated the role of an experience rating in resolving information asymmetry in the market by using a simulation.[19] They found that experience-rated contracts are less susceptible to pricing inefficiency due to moral hazard and adverse selection than contracts that are not experience-rated. Chiappori and Salanié (2000) tested whether information asymmetry exists in the French automobile insurance market by using the empirical market data and found that a risk-based rating system, including experience ratings, can eliminate adverse selection and moral hazard.[20] Grace et al. (2001) examined the automobile insurance reform in the state of South Carolina and found that the overall premium rate level fell and the residual market facility almost disappeared soon after the deregulation. They concluded that these positive outcomes are attributable

15） Hoy (1982), pp.321-336.
16） Doherty (2000), pp.76-86.
17） Harrington and Doepinghaus (1993), pp.62-72.
18） Suzawa (2008), pp.31-49.
19） Doepinghhaus and Moor (1994), pp.95-103.
20） Chiappori and Salanié (2000), pp.56-78.

to the introduction of risk-based pricing, rather than regulated pooled pricing, in the voluntary market.[21] Barkume and Ruser (2001) investigated the impact of rate deregulation on workers' compensation insurance in the U.S. and found that the reform of the statutory rating bureau and elimination of a prior approval system reduced not only the long-term premiums but also the injury rates.[22] Lee (2009) analyzed the influence of the automobile insurance rate deregulation in South Korea by measuring the change in market concentration, insurance premiums, distribution channels, and insurance products/services, and found that price liberalization promotes competition and increased consumer benefits.[23]

In empirical research investigating the Japanese automobile insurance market, Miyashita and Yoneyama (2007) focused on voluntary automobile insurance and found that a shift to this insurance line significantly contributes to the cost efficiency of insurers regardless of the regulatory change, on the basis of the data from 1970 to 2003.[24] Suzawa and Miyashita (2007) conducted a quantitative analysis by using panel data from 1996 to 2005 and observed that higher composition ratios of the earned premiums to the total premiums of voluntary automobile insurance contribute to the profitability of insurers in the post-deregulation period.[25] Miyashita et al. (2008) conducted comparative analyses on pre- and post-deregulation periods on the basis of the panel data from 1970 to 2005 and demonstrated that insurers tend to enhance their efficiency by diversifying their insurance policy portfolios, rather than adopting a concentration strategy, in both regulated and competitive marketplaces.[26] Yoneyama and Suzawa (2010) tested how the unified premium rate system of CALI and earthquake insurance affects non-life insurers' profitability for the 1985–2008 period, and found that the market expansion of CALI tends to enhance the insurers' profitability for both pre- and post-deregulation periods, but an increase in the composition ratio of the same insurance line appears to deteriorate profitability performance only after deregulation.[27]

4. Research Approach

Equilibrium Model for Auto Insurance Risk Classification. In order to construct an analytical model for the division of roles between compulsory and voluntary automobile insurance, we expand the

21） Grace et al. (2001), pp.1-68.
22） Barkume and Ruser (2001), pp.37-63.
23） Lee (2009), pp.1-76.
24） Miyashita and Yoneyama (2007), pp.1-41.
25） Suzawa and Miyashita (2007), pp.101-119.
26） Miyashita et al. (2008), pp.1-26.
27） Yoneyama and Suzawa (2010), pp.1-17.

discussion by Doherty (2000)[28] on risk classification in the automobile insurance market, as illustrated in Figure 1. The axes in the (W_1, W_2)-space show the wealth of a driver under two circumstances: one with a loss incurred from an accident and the other with no loss. For simplification, we assume that an equal number of only two risk types, low- and high-risk drivers, exist and have the same endowment level at Point A, where both types of risks are uninsured. Line F traces out equal values on both axes, indicating a state of full insurance coverage (i.e., $W_1 = W_{2)}$. Without risk classification, a risk-neutral insurer charges the pooled fair premiums from both types of drivers along Line P: $p/(1 - p)$, where p denotes the average probability of an accident for all drivers. In a case where risk classification is introduced, the insurer can exchange wealth from the loss-free state: W_1 to the loss state: W_2 along Line P_L: $p_L/(1 - p_L)$ for low-risk drivers and Line P_H: $p_H/(1 - p_H)$ for high-risk ones. p_L and p_H denote the probability of loss occurring for low- and high-risk drivers, respectively, and are characterized by $p_L < p_H$. Line P_L is thus steeper than Line P_H.

Meanwhile, the slope of the indifference curve for low-risk drivers is given by the ratio of probability-weighted marginal utilities as follows:

$$EU_L: \partial W_1/\partial W_2 = -(p_L \partial U/\partial W_1)/[(1-p_L)\partial U/\partial W_2]$$

Similarly, the indifference curve for high-risk drivers is illustrated by the following equation:

$$EU_H: \partial W_1/\partial W_2 = -(p_H \partial U/\partial W_1)/[(1-p_H)\partial U/\partial W_2]$$

Since $W_1 = W_2$ on the security line implying $\partial U/\partial W_1 = \partial U/\partial W_2$, this slope becomes $p_H/(1 - p_H)$. The equality of the slopes indicates that the optimum must lie on the security line, such as Point H for high risks and Point L for low risks. If recognized as such, the high risks are, therefore, offered a contract at rather unfavorable terms that still induces them to purchase full coverage.

The insurer may actually determine Point H in a trial and error process, offering a high-premium contract and observing some individuals buying full coverage nevertheless. Again, by trial and error, the insurer may determine Point L, where another low-risk group purchases a policy featuring only partial coverage, but at a favorable premium. At the same time, the high risks will not give up their full coverage at Point H in favor of another insurance policy at Point L, where their indifference curve EU_H passes, showing constant expected utility. Therefore, under certain conditions, the contract pair (H, L) may constitute a separating equilibrium.

28） Doherty (2000), pp.76-86.

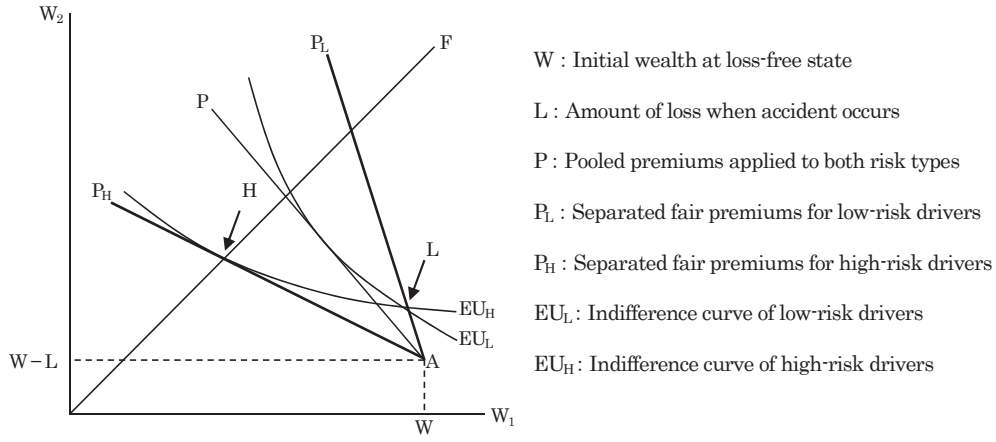

Figure 1 Separating Equilibrium under Risk Classification

Analytical Model of Partial Compulsory Auto Insurance. Zweifel (2000) analyzed the roles of private and social insurance on the basis of the equilibrium model, as referred to in the previous section, but the scope of the insurance lines is limited to the life and health insurance sector, including provision for old age, disability, workers' compensation, sick leave pay, health care, long-term care, and unemployment, where the government provides insurance coverage, at least partly, in many developed countries.[29] Zweifel (2000) demonstrated equilibrium points for both low- and high-risk individuals, avoiding adverse selection, but did not articulate the optimal domain of social insurance, which efficiently induces all individuals to participate in the system, and that of private insurance, which can avoid excessive risk differentiation and cream skimming. We thus follow the approach of Zweifel (2000), but extend it to the automobile insurance sector provided by private insurers.

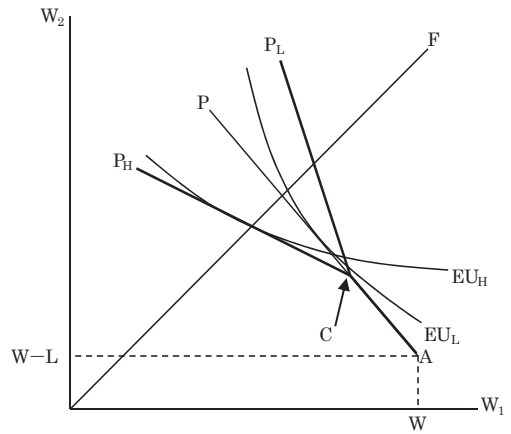

Figure 2 Partial Compulsory Auto Insurance with Excess Voluntary Coverage

29) Zweifel (2000), pp.933-966.

We construct a model that analyzes the division of labor between CALI and voluntary automobile insurance, as illustrated in Figure 2. The insurer offers a CALI contract at a pooled price, providing only partial coverage at Point C. If the loss exceeds over the limitations of CALI, the insurer provides coverage with risk-separating premiums along Line P_L for low-risk drivers and Line P_H for high-risk ones.

In the following sections, we attempt to specify an optimal domain for compulsory insurance to cost efficiently ensure the participation of all drivers and avoid adverse selection, and also construct a model for illustrating the extent to which voluntary insurance provides coverage, as well as a risk-classification design for avoiding excessive costs and cream skimming.

5. Analyses of Possible Cases

Excessive Coverage of Compulsory Auto Insurance. First, let us consider a case in which compulsory automobile insurance provides partial but excessive coverage at a pooled price for both low- and high-risk drivers. The point where the insurer offers CALI coverage is identified as C' in Figure 3. The part of loss exceeding Point C' is covered by risk-differentiated voluntary automobile insurance, and thus, the fair-price lines for low- and high-risk drivers are illustrated as Line P_L' and Line P_H', respectively.

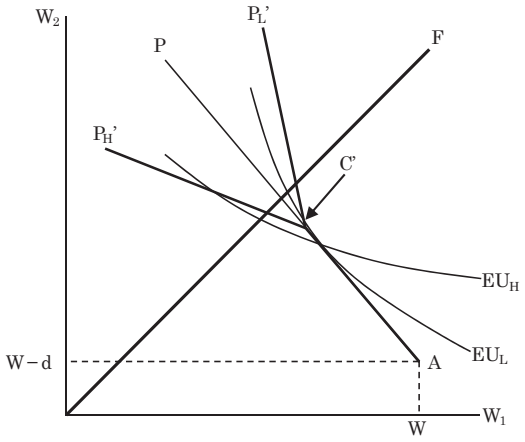

Figure 3 Excessive Compulsory Auto Insurance

In this case, Point C' falls over EU_H and induces high-risk drivers to participate in the CALI system, as they regard the coverage as a good deal. However, Point C' is not always located above the indifference curve of low-risk drivers. If CALI is provided below EU_L, low-risk drivers assume that CALI coverage is unreasonably expensive and have an incentive to withdraw from the compulsory insurance system.

Thus, the insurer and the policymaker possibly have to incur additional costs to screen uninsured motorists and enforce them to purchase the CALI coverage. In order to ensure that all motorists are insured, CALI utilizes the vehicle inspection system, as mentioned in the previous section; a valid insurance certificate must be presented both at the time of initial registration of an automobile and at each vehicle inspection, carried out periodically by administrative authorities thereafter. The insurance policy period is required to cover the full length of the time before the next inspection.[30] The utilization of this external device appears to cost effectively preclude any uninsured motorist and resolve the problem of adverse selection.

However, even in the case where all drivers would be forced to be insured, some low-risk drivers who perceive the insurance coverage to be expensive may change their behavior as if they were high-risk drivers. Such potential moral hazard can also impose a cost burden on insurers to avoid it.

Insufficient Coverage of Compulsory Auto Insurance. What would happen if CALI were to provide only a limited amount of coverage to avoid adverse selection and moral hazard? Assume that the insurer makes an offer of CALI coverage at Point C'' and sells voluntary coverage over the limitation of CALI, as illustrated in Figure 4. The insurer can profitably underwrite voluntary automobile insurance policies as long as he/she earns prices below Line P_L'' for low-risk drivers and below Line P_H'' for high-risk ones.

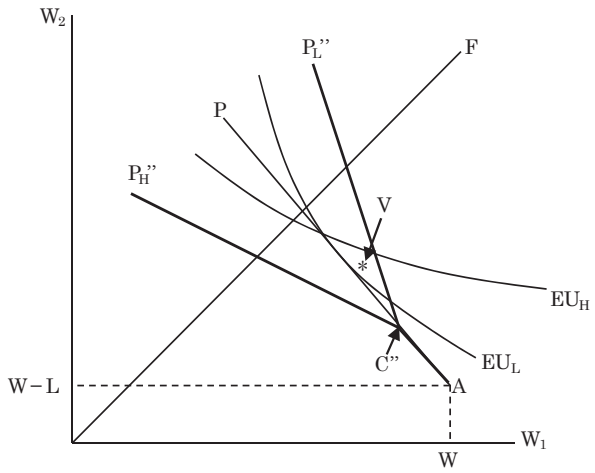

Figure 4 Insufficient Compulsory Auto Insurance

30) Non-life Insurance Rating Organization of Japan (2010), p.6. Intervals between vehicle inspections depend on the type of automobile. Private passenger automobiles, for example, are required to receive the inspection every two years. However, certain types of vehicles including mopeds and light automobiles are exempted from periodical vehicle inspections.

We should, however, consider the voluntary sector of insurance. Let us assume that an insurer decides to offer voluntary automobile insurance at Point V, which is well below Line P_L; that is, the price of the coverage remains profitable only for low-risk drivers. Point V passes the indifference curve for low-risk drivers, EU_L, but it is beyond the affordable area for high-risk ones. Thus, the insurer would be able to draw low-risk drivers into its policy portfolio and exclude high-risk ones in a costless manner, resulting in an impairment of availability and affordability of insurance coverage and an increase in the number of under-insured drivers. Moreover, another insurer may decide to provide voluntary coverage at slightly above Point V for attracting drivers with favorable risk characteristics. Under competitive pressure, the cream-skimming strategy adopted by one insurer may induce other insurers to follow the same measure, resulting in excessive risk classification regardless of cost.

As a solution to the problem of insurance availability and affordability, some countries have introduced assigned risk plans, which are arrangements for assigning individuals with risks unacceptable in the standard insurance market to a qualified insurer so as to guarantee coverage, typically at a subsidized pooled price.[31] All insurers licensed to sell automobile insurance policies are usually required to financially contribute to this facility, and this additional cost is ultimately shared among the concerned parties including insurers and policyholders, which possibly results in an impairment of market efficiency. The Japanese automobile insurance market has no assigned risk plan thus far, which may imply that the double-layered insurance system successfully contributes to the preservation of the availability of insurance coverage.

In addition, although voluntary inusures are allowed to use their own rating plans by obtaining prior approval from the regulatory body, as described in the previous section, the risk factors that they are permitted to use include driver's age, gender, driving experience, and purpose of automobile usage. The strict price regulation over the voluntary automobile insurance market may effectively ward off the fierce price competition among insurers and cream skimming in so far as the cost of the regulatory implementation is not excessive.

Optimal Division of Roles between Compulsory and Voluntary Auto Insurance. Focusing on compulsory insurance, under the condition that CALI provides identical coverage for all drivers at the same premium rates regardless of their risk characteristics, the insurance policy must attract all drivers to participate in the insurance system in order to avoid excessive costs to enforce them to do so. This means that the compulsory coverage, denoted by Point C in previous figures, must pass beyond the indifference curves for not only high-risk drivers but also low-risk ones (i.e., EU_H and EU_L). Then, high-

31） Skipper and Kwon (2007), pp.251-252.

risk drivers would be willing to purchase partial coverage, while low-risk drivers would consider the rational of the offered premiums, even though they are pooled with the high-risk group. Meanwhile, losses in excess of the loss limitations of CALI are covered by voluntary coverage for which premium rates are set separately on the basis of the risk characteristics of individual drivers. In order to have for-profit private insurers willingly underwrite insurance policies, the price of the coverage should be set at a sufficient level to avoid underwriting losses. Thus, the voluntary insurance coverage must be provided below the fair-price lines (i.e., Line P_L or Line P_H, according to the risk characteristics of individual drivers).

Where is the point that divides the domains of compulsory and voluntary automobile insurance? Consider Point C*, which is the contact point between the fair-price line of pooled prices and the indifference curve of low-risk drivers, EU_L. If the compulsory coverage is provided at Point C* at the pooled price, not only high-risk drivers but also low-risk ones recognize it as being reasonable and willingly participate in the pooled insurance system. Thus, the cost of screening uninsured motorists and enforcing them to purchase an insurance policy can be minimized. For the surplus area from Point C*, risk-differentiated voluntary coverage should be offered. In the voluntary market, low-risk drivers can purchase limited but low-cost insurance coverage that reflects the probability that they will cause an accident, while high-risk individuals can be insured by a sufficient but relatively expensive coverage that they regard to be necessary. As a result, the voluntary automobile insurance market can cost effectively avoid excessive price competition and an increase in uninsured motorists.

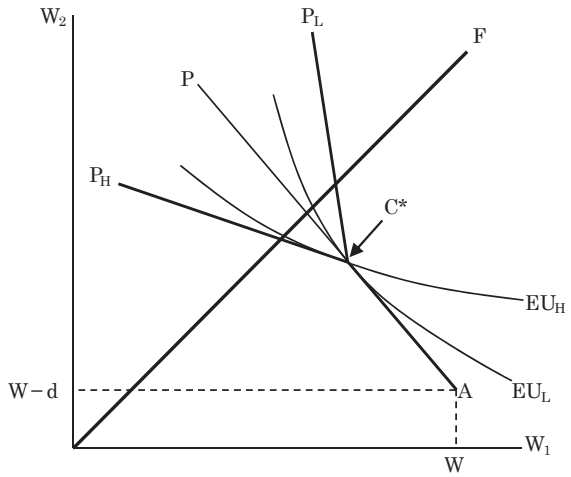

Figure 5 Optimal Domain of Compulsory and Voluntary Auto Insurance

6. Summary and Conclusion

This study attempts to construct a theoretical framework for the division of roles between compulsory and voluntary automobile insurance by observing the Japanese automobile insurance scheme. The Japanese automobile insurance market is unique since it has a double-layered structure; CALI provides the basic layer of coverage for bodily injury liability, while voluntary insurance covers excess losses over the compulsory insurance, as well as property damage liability, insurer's injury, and insurer's vehicle damage. This insurance scheme has successfully ensured the availability and affordability of insurance coverage for automobile liability risks and minimized the number of uninsured motorists. CALI is, however, potentially exposed to possible adverse selection since it provides the standardized coverage at pooled premiums for all policyholders regardless of their risk characteristics. Meanwhile, in the voluntary automobile insurance sector, insurers may engage in excessive risk classification and limit their supply of insurance products for high-risk drivers. We try to find an optimal division of roles between CALI and voluntary automobile insurance that effectively prevents such problems and minimizes transaction costs imposed on insurers, policyholders, and the regulator.

From the analysis based on the Separating Nash equilibrium model, we find that the combination of excessive CALI coverage and limited voluntary coverage may help to mitigate the adverse selection and moral hazard problems. Low-risk drivers will have an incentive to withdraw from the compulsory insurance scheme, resulting in a cost increase for compulsion. Even if they are forced to participate in the insurance portfolio, low-risk individuals may change their behavior to increase the expected losses. On the other hand, insufficient coverage of CALI can possibly induce excessive risk classification in the voluntary market for insurance regardless of its cost, which eventually would be imposed on not only insurers but also policyholders. Moreover, insurers under competitive pressure may engage in cream skimming by offering an insurance coverage that exclusively attracts low-risk drivers. The potential threat to the availability of insurance could raise the necessity of other costly solutions, including assigned risk plans.

What is the optimal level of compulsory coverage to minimize adverse selection and the cost of compulsion? How should voluntary coverage be provided to preserve the availability of insurance and avoid excessive risk classification? We determine that the contact point between the fair-price line of the pooled insurance premium and the indifference curve of low-risk drivers should divide the domains of CALI and voluntary automobile insurance. If CALI provides standardized partial coverage at this point at the pooled price, all drivers are expected to consider the coverage to be reasonable and will willingly participate in the compulsory insurance system. Thus, the cost of screening uninsured motorists and ensuring compulsion can be minimized. At the same time, insurers should offer voluntary insurance

in the surplus area of the dividing point on the risk-differentiated basis so that individual drivers can purchase coverage suitable for their risk characteristics through the self-selection mechanism. Thus, excessive risk classification and cream skimming can be avoided and the sufficient supply of insurance coverage can be maintained in the voluntary market.

We find that the double-layered automobile insurance scheme is cost-effective in minimizing adverse selection and preserving insurance availability, provided that the compulsory insurance and voluntary insurance markets mutually divide their roles within their own optimal domains. However, we cannot ignore the possible additional transaction costs of the double-layered system that could be imposed on the parties concerned. Hence, insurers need to prepare two types of underwriting policies and premium rate plans, as well as follow different regulatory processes. Policyholders have to enter into separate contracts and hold two different policies, while the regulator has to enforce two different regulatory controls. Constructing a more robust model to include these explicit cost factors will enhance the viability of this alternative insurance scheme and provide stronger incentives to create a framework for the division of roles between compulsory and voluntary automobile insurance not only in the Japanese market but also other jurisdictions with a variety of market characteristics. Given these benefits, the double-layered insurance scheme merits further research.

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強制保険と任意保険の機能分担に関する経済分析
—— わが国の自動車保険制度を中心に ——

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【要旨】

本研究は，わが国の自動車保険制度分析をとおして，強制保険と任意保険の機能分担に関する理論的枠組の構築を試みたものである．事実上の統一料率のもとで運営される自賠責保険と，一定のリスク細分化が許容される任意自動車保険との二層によって構成されるわが国の自動車保険制度は，保険の入手可能性を確保し無保険運転者の増加を回避してきた点において，評価されるべきものである．しかしながらこのような保険の二層構造は，保険者，保険契約者および規制監督者に対して追加的な取引コストを課しているかもしれない．いっぽうで自動車保険に焦点をあてて強制保険と任意保険の適切な領域を分析した先行研究は管見の限り多くはない．本研究は，医療保険分野において公的保険と民間保険の領域分析を，市場均衡モデルを用いて試みた Zweifel（2000）の研究を基礎としながら，わが国の自動車保険市場実態に適用可能な分析モデルを構築し，現在の制度の有効性を分析した．その結果，プール保険料の適正価格線と低リスク者の無差別曲線との接点において自賠責保険が提供され，それを超えた領域においてリスク細分化を伴う任意自動車保険が提供される限りにおいて，二層構造の自動車保険制度は，保険の入手可能性を確保すると同時に逆選択を防止しうることがわかった．

キーワード：自賠責保険，任意自動車保険，市場均衡モデル，保険の入手可能性，逆選択